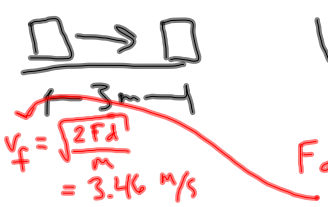
Work and Energy Practice Problems and Notes 9.22.11 AP Physics

A 6.0 kg block initially at rest is pulled to the right along a horizontal, frictionless surface by a constant horizontal force of 12 N. Find the block's speed after it has moved 3.0 m.



$W = \Delta KE$

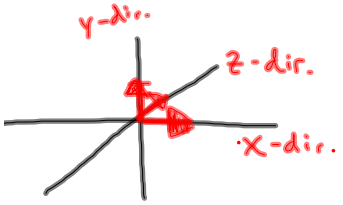
$Fd = KE_f - KE_i$

$\vec{F} \cdot \vec{d}$ Dot product = scalar

$\vec{a} \times \vec{b}$ Cross product = vector

magnitudes, directions

$\langle a_x \hat{i}, a_y \hat{j}, a_z \hat{k} \rangle$



$\hat{i}$ → unit vector in x-dir.

$\hat{j}$ → unit vector in y-dir.

$\hat{k}$ → unit vector in z-dir.

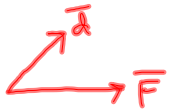
Dot product: $\hat{i} \cdot \hat{i} = 1 \quad \hat{j} \cdot \hat{j} = 1 \quad \hat{k} \cdot \hat{k} = 1$

$\vec{A} = A_x \hat{i} + A_y \hat{j} + A_z \hat{k}$

$\vec{B} = B_x \hat{i} + B_y \hat{j} + B_z \hat{k}$

$\vec{A} \cdot \vec{B} = A_x B_x + A_y B_y + A_z B_z$

Relating to us:



$\vec{F} \cdot \vec{d} =$

$$\vec{A} \times \vec{B} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ A_x & A_y & A_z \\ B_x & B_y & B_z \end{vmatrix}$$

$$= \hat{i}(A_y B_z - A_z B_y) + \hat{j}(A_x B_z - A_z B_x) + \hat{k}(A_x B_y - A_y B_x)$$

Gravitational Potential Energy:

$$U_g = m a_g h$$

- Choose our zero point in y-axis

$$\Delta U_g = m a_g \Delta h$$

$$= m a_g (h_f - h_i)$$

$$W = \Delta U_g$$

More general work...

$$W = \Delta K + \Delta U$$

Conservative v. Non-Conservative forces:

Conservative forces:

- work independent of path taken by particle
- work for closed path is zero

Non-Conservative forces:

- any force that increases or decreases the energy of a system

A bowling ball held by a careless bowler slips from the bowler's hands and drops on the bowler's toe. The distance the ball falls is 0.5 m, and the mass of the bowling ball is 7.0 kg. Find the change in gravitational potential energy of the bowling ball when it falls.